ISSN 2407-4527
E-ISSN 2460-1047

LEMMA : Letters of Mathematics Education
Volume 5, No. 1, Desember 2018, pp. 52-64

THE GRAPHING SKILL OF LINE EQUATION AND QUADRATE EQUATION AT THE FIRST YEAR STUDENTS

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Abstract

The drawing a graph of the equation is positioned by it as the material prerequisites that must be mastered to solve the problems on the subject. However, based on teaching experience for many students who indicated not been able to describe the graph equation graph. The study aims to describe the students' ability to draw graphs of quadratic and line equations,of first-year students who took Calculus subject at Mathematics Department, Padang, Indonesia. The data source was selected purposive and snowball sampling. Sources of data in this study were 70 first year students in Differential Calculus subject class. Research shows that understanding of students to graph a quadratic equation is still very low, they often mixed graphs of quadratic equations and linear equations, and understanding of students to graph line equation is still very low, especially on understanding the line y = k and x = k, k is a number.

Keywords: Graph, line Equation, quadratic equation, skill.

Abstrak

Menggambar grafik persamaan merupakan materi prasyarat yang harus dikuasai dalam menyelesaikan permasalahan pada mata kuliah Calculus. Namun berdasarkan pengalaman selama mengajar masih banyak mahasiswa yang diindikasikan belum mampu menggambarkan grafik persamaan Penelitian bertujuan untuk mendeskripsikan kemampuan mahasiswa dalam menggambar grafik persamaan kuadrat dan persamaan garis, Penelitian merupakan penelitian kualitatif, dengan subjek penelitian terdiri dari 70 mahasiswa tahun pertama yang mengambil Kalkulus di Prodi Pendidikan Matematika, STKIP PGRI Sumatera Barat, Padang, Indonesia. Sumber data dipilih secara *purposive* dan bersifat *snowball sampling*. Sumber data dalam penelitian ini adalah 70 mahasiswa yang mengambil Mata Kuliah Kalkulus Diferensial. Penelitian menunjukan bahwa Pemahaman mahasiswa terhadap grafik persamaan kuadrat masih sangat rendah, masih sering mencampurkan grafik persamaan kuadrat dan persamaan linier, dan pemahaman mahasiswa terhadap grafik persamaan garis masih sangat rendah,terutama tentang pemahaman terhadap garis y = k dan x = k, k suatu bilangan.

Kata kunci: Grafik, persamaan garis, persamaan kuadrat, keterampilan.

Cara Menulis Sitasi: Zulfaneti, S Edriati, Mukhni. (2019). *The Grapping Skill of Line Equation and Quadrate Equation at the First Yaer Students . Lemma, Volume 5 No 1* halaman 52-64.

Mathematics can not be separated from the mastery of mathematical concepts. Mastery of concepts at a higher level is very dependent on the mastery of mathematical concepts at previous levels. Although teacher teaching techniques also influence students 'understanding, the diversity of learning strategies can improve students' understanding. The concept of

mathematics in college is not different from the concept of mathematics at secondary school level and even at the primary level, which distinguishes only mathematical concepts to universities further expanded and deepened. Mathematics is a universal language which has been formed as a result of the studies of scientists continuing for years; which has unique rules; and which provides communication between all the people in the world regardless of the fact that whether these people deal with mathematics or not (Sahin & Soylu, 2011).

The expansion and deepening of the concept is of course adapted to the development of the capabilities of the individual. Mastery of the material in college, can not be separated from the mastery of the material at the previous level. The fundamental fallacy experienced when studying in primary school would be difficult to repair and affect the development of personality. Therefore, if an error occurs on a concept in students, the concept will be carried on and difficult to change. Prospective teachers have Some typical mistakes were identified as follows: (1) inappropriate transformation of functions and equations; (2) inappropriate use of graphic representations, and (3) inappropriate logical reasoning in algebra (Huang & Kulm, 2012)

The ability to draw a graph of the function is one of the important capabilities in Mathematics and a few disciplines apply. Graphs are the most frequently used visual tools while they allow summarizing sets of data and representing complex relationships between variables effectively (Kilic, Sezen, & Sari, 2012). Other than one, Overall, graph familiarity had no significant impact on writers' performance on either of the graph task, while content knowledge and writing ability had significant and positive effects on test performance (Yang, 2016). So if there misconceptions about drawing graphs of functions, students will find it difficult to understand the concept that use the application of function graph (Rahmawati, 2014). It can not be separated from the mastery of the cartesius graphics. Understanding and using Cartesian graphs is a crucial component of high school mathematics and science courses (Font, Bolite, & Acevedo, 2010). Methods course involving the mathematical knowledge for teaching function supported the development of mathematical knowledge that built on individual teachers' prior knowledge as well as the development of a stronger collective understanding of function (Steele, Hillen, & Smith, 2013)

Graphs of quadratic equations and graph equation of the line is one of the prerequisites material in some subject at Department Mathematics Education STKIP PGRI Sumatera Barat. Such as Calculus, Linear Program, Mathematical Statistics and others

positioned to graph equations, including quadratic equations and graph equation of the line as a matter that must be mastered to solve the problems on this subject. However, based on teaching experience for many students who indicated not been able to describe the graph equation graph even simple equations such as quadratic equation $y = x^2$ and $y = x$. Students were familiar with families of functions, many were unable to give an appropriate definition or recognize whether a given graph or rule represents a function; and could not make correct connections between function graphs and tables of values (Bardini, Pierce, Vincent, & King, 2014).

Rahmawati (2014) states that the factors causing misconceptions in drawing graphs of functions are misconceptions in understanding the concept of the prerequisites for drawing graphs, namely the definition of functions and graphics, do not understand the point coordinates and correspondence notation. In addition, other factors in students is the lack of exercise drawing graphs of functions or the student experience (Rahmawati, 2014)

Material graphs of quadratic equation is part of the materials quadratic equation. Comprehension completion quadratic equations affect the ability of students to draw a graph. But there are still many students who have difficulty in solving quadratic equations resulting material related to the quadratic equation can not be solved properly. There are three mistakes made by students in solving a quadratic equation is a mistake in identifying the properties of quadratic equations and concepts to identify the conditions specified concept, using the formula of the maximum value, and ignore an important step in the completion (Nuriyah, 2015). This mistake is also due to the knowledge factor that the previous student possessed, There was a positive relationship between individuals' prior subject matter knowledge and their contributions to argumentations (Hakyolu & Bekiroglu, 2016)

Many students have not been able to develop the necessary concepts in solving mathematical problems (Rina & Zulfaneti, 2013). Errors in the participants answered the item is defined as a response to items that do not correspond with the expected response (Gierl, 2007). Diagnosis errors made students an activity to find the response of participants who do not fit the pattern of responses expected or ideal response patterns, based on symptoms in the form of a response to items in mathematical answered the item. Students who have learning difficulties can make a mistake in answering the items (Isgiyanto, 2011). Among the findings, errors of students in doing mathematics is as follow:

1. concept error found is (a) students can not apply the theorem, formulas, concepts or properties appropriately, (b) the student can not write out a formula or theorem

correctly, and (c) the student can not formulate a concept or a mathematical model correctly,

2.misinterpretation of the language found are (a) the student can not make sense of everyday language into mathematical language correctly, (b) the student can not interpret the notation, symbols, graphs, tables or images into mathematical language correctly, and (c) students are not able to interpret the language of mathematics into everyday language correctly,

3.procedural errors found are (a) the student can not apply the algorithm correctly, (b) the student can not perform manipulation algorithms correctly, and (c) students can not use reasoning correctly,

4.The counting errors found are (a) the student can not perform the correct computation, (b) students can not apply (c) arithmetic operations or operations with proper algebraic form, and (d) students are not able to perform calculations carefully

Additionally, Febriana (2013) states that the mistakes made by students in solving mathematical problems are misconceptions, and in general the students understand the intent of the question, and do not know how to solve it (Rina & Zulfaneti, 2013). Errors in solving problems is also influenced by the critical thinking skills of students, Rasiman (2015) stated that three types of student understanding in resolving the matter which is 1) Students are not critical at all, namely hamya able to identify facts 2) Students who are less critical, can be identifying the facts and have knowledge to finish 3) students' critical thinking that students can identify the facts, know the proper knowledge but less accurate in the finish, and 4) students were very critical that students can identify the facts, know the proper knowledge and accurate (Rasiman, 2015)

This study focused on students' understanding of the graphic description of the quadratic equation and line, the research questions are as follows:

1. How does students' understanding to the coordinate system
2. How does students' understanding to graphs of quadratic equations
3. How does students' understanding to graph equations line

METODE

This study was descriptive qualitative research. Subjects were 70 students who take Differential Calculus Subject in Mathematics Education department of STKIP PGRI Sumatera Barat, it selected purposively and is snowball sampling.

Instruments have been used in this research is essays test. The tests used a test that can gauge student understanding and ability 1).Against the Cartesian coordinate system, 2) In draw a simple graph (line equation and a quadratic equation), 3) to graph y = c and x = c.

Grating of tests are given in Table 1.

Table 1. Grating of Test for Cartesian Coordinate System and Line and Quadratic Equation

No	*AIMS*	*INDICATOR*	*Test Number*
1	To determine the students' understanding of the Cartesian coordinate system	Position points on the Cartesian coordinate system	1
2	To determine the ability of students to draw a simple graph (line equation and quadratic)	Line equation graph and quadratic	2a, 2b, 2c, 2d, 2e, 2f, and 2g
3	To determine the students' understanding of the graph of y =c and x = c	Graph aligned parallel to the x-axis and y-axis	3a, and 3b

The data collection technique used is the technique of triangulation. Triangulation technique is a technique that is combining the data collection of various techniques and data sources. If collecting data by triangulation, the actual researchers collected data as well as test the credibility of the data, ie checking the credibility of the.

Data analysis technique used is descriptive technique on students' understanding of the equation and a quadratic equation, which begins by tracing the student's understanding of the Cartesian coordinate system. Data collected is presented in the table then interpreted and viewed relevance to theories or literature used. The data collected in the form of table data on the number of wrong answers, the correct answer number and the number who did not answer. In addition, the data collected typology of student answers. The data is then interpreted descriptive

HASIL DAN PEMBAHASAN

The results of the tests are given five types of questions to 58 students. Problem number 1 aims to determine the student's understanding of the coordinate system. There are seven types of answers of students, namely 1). The point has been imaged correctly, but it seems that is considered the point is the line, 2) Point (0, 4) was not described incorrectly, it was described at the Point (3,0) or on other coordinate, 3) Point (-3,2) was described not true, it was described at Point (2,-3), 4) All the points in the image correctly, but coupled with the line connecting the origin with (-3.2) and the origin with (3,4), 5) All the points in the image correctly, but coupled with a graph that connects the points., 6) Point (-3.2) is described as a line connecting (-3.0) to (0.2), and points (3.4) as the line connecting (3.0) to (0.4), 7) Point (-3.2) is described as a line connecting (-3.0) to (0.2), and points (3.4) is the line connecting

(3.0) to (0.4. These data provides information that there are students who do not understand the meaning of point (x, y).

Results of student answers about drawing point coordinate system was seen that students know to make a point on the Cartesian coordinates where the vast majority (84%) of students had answered correctly. Students who answered incorrectly (16%) have the misconception, which are

a. Students assume the point as a line, for example, create a line connecting a point , or even consider the point (x, y) is a line connecting (x, 0) to (0, y).
b. Students do not understand the meaning of the form coodinates (x, y), they does not understand that x is ordinate and y is absis so that the dots drawn at random
c. Point (x, y) was is described reversed for example the point (-3.2) drawn at (2, -3)

Some examples of student answers that are not in accordance with these concepts, such as Figure 1, Figure 2, Figure 3 and Figure 4

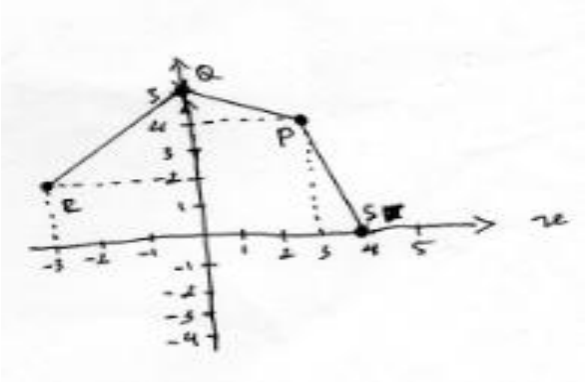

Figure 1. Examples of errors to draw a point, namely as regards point line

Figure 1 reflects that in describing the coordinates of a point of students affected by engineering a graphical representation of linear equations. Another thing that is estimated to affect students' understanding is to misinterpret the command on the matter, which assumes that the object is to connect the dots request

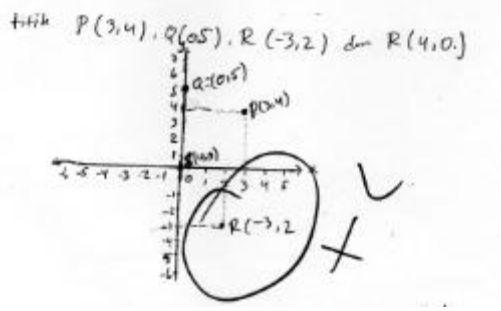

Figure 2. Examples of errors to draw a point, namely reverse depicts (-3.2)

Figure 2 student shows misunderstand between abscissa and ordinate, they misunderstanding of the system (x, y).

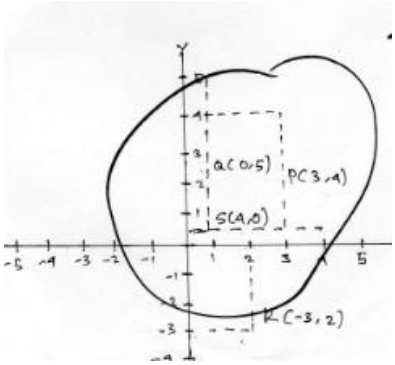

Figure 3. Examples of errors to draw a point, siswa menganggap titik adalah garis

From Figure 3 that the students do not fully understand the system of coordinates (x, y) and their understanding of the influence of the graph equations straight line.

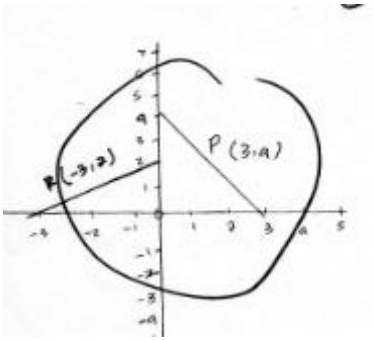

Figure 4. . Examples of errors to draw a point, students assume the point (-3, 2) is a line connecting (-3.0) and (0, 2)

Figure 4 shows the student errors in describing the point (-3.2) and (3,4), it appears that the student connects the points (-3, 0) and (0, 3)

Simple Graphing Skills (Equation Line and Quadratic Equations)

Problem number 2 aims to determine students' ability to draw a simple graph (equation and a quadratic equation). For problem 2a, college students were asked to draw the graph y = x + 1. Obtained results are 1) The Line y = x + 1 is described as another line but the shape they resemble the line y = x + 1 is a positive gradient, for example, is described as the line y = x, y = x -, y = x + 2 and so on, 2) The Line y = x + 1 is described as a negative gradient line, 3) The Line y = x + 1 is described as a point, 4) The line y = x + 1 is described as a graph of the quadratic equation, and 5) The Line y = x + 1 is described as a area. These data presents that there are still many students who can not afford / fail to draw a sketch of the line

y = x + 1. Answer students have already leads but is not precise and students graph a line as the graph of quadratic equations.

Next problem Question 2b, obtained result are 1) Graph is already similar to the line y = x, but shifts down / up, or no line through the origin (0,0), 2) The line y = x is described as a square line that passes through (0, -1), 3) The line y = x is described as a graph of the quadratic equation $y = x^2$ or curved as graphs of quadratic equations, 4) The line y = x depicted as shaded areas, 5) The line y = x is described as the line y = c, and 6) Students are only to determine the point of help, and some auxiliary point, there are still wrong (or do not meet the y = x. These result presents that the students are not able to draw a line graph y = x, which can not be certain form of graphics, and much mixing with knowledge of graphs of quadratic

Answers to the Question 2c have 7 answers type are 1) The Line y = -x is described as a graph of the quadratic equation $y = -x^2$ or curved, 2) The Line y = -x is described as the line y = x, 3) The line y = -x does not pass through the origin, but shifted to the top, 4) Line y = -x described is similar to the line y = x, but shifted as far as 1 unit down (past the (0, -1) and (1,0), 5) The line described as a shaded area, 6) The line y = -x is described as the line y = c, and 7) Only able to draw auxiliary point. Almost the same as the student answers in Question 2b presented at Table 4, it appears that they do not interpret the equation of a line with good form and mixed with other knowledge such as quadratic equations

Meanwhile, when asked to create the graph y = 0 and x = 0 is still much doubt and confusion drawing. Answer students as shown in Table 2

Table 2. Answers to the Question 2d and 2e

No	The answer type for the graph y = 0	The answer type for the graph x = 0
1	Only able to draw auxiliary point	Only able to draw auxiliary point
2	The line described as a shaded area	The line described as a shaded area
3	The line y = 0 is described as the point (0,0)	The line x = 0 is described as the point (0,0)
4	Just draw the x-axis and y-axis	

Furthermore, to determine students' understanding of the graphs of quadratic equations, with the request to make the graph y = x2 and y = x2-1, obtained the results as shown in Table 3

Table 3. Answers to the Question 2f and 2g

No	The Answers Type For graph $y = x^2$	The Answers Type For graph $y = x^2 – 1$
1	Only able to draw auxiliary point	Only able to draw auxiliary point
2	The shape is wrong	The shape is wrong
3	Graph curved downward	

Although most students have been able to draw a point, but when followed by a command to draw a line graph y = x + 1 is only 17% right, 36% answered incorrectly and the remaining 47% did not answer. Among the 36% who answered incorrectly, still largely resembles the outline requested but still not right, for example, y = x + 1 is described as a graph y = x - 1, or the line y = x, but when asked to describe the line y = x instead only answered as a dot and the line y = - x instead in the picture as the line through the point (1, 0) and (0, -1) or graph y = x - 1. these errors imply that the student has not properly interpret graphs requested. Inaccuracy of students as in Figure 5

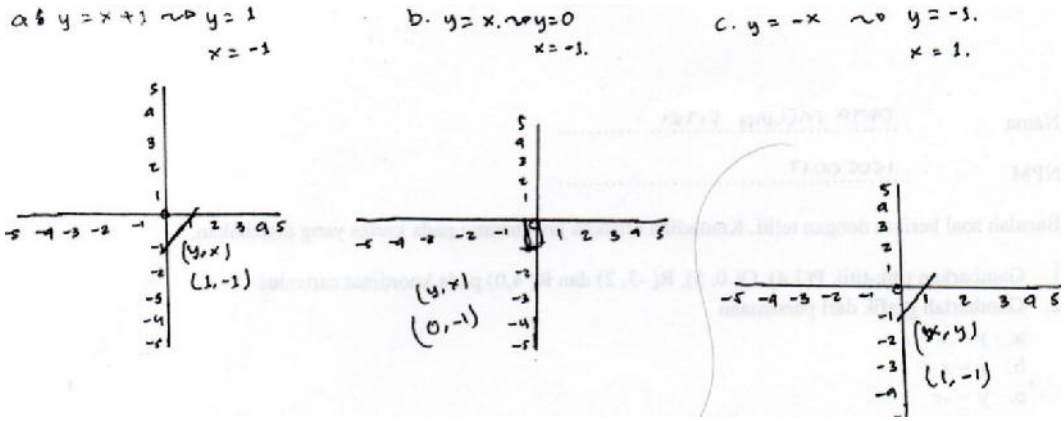

Figure 5. Example of a mistake to draw the line y = x + 1, y = x and y = -x

From Figure 6 it appears that in drawing the graph y = x + 1, students trying to make a point to help the point of intersection with the x-axis and y-axis cutting point. This cut-off point that is seen is correct (0, 1) and (-1, 0) but a misunderstanding by creating a new point (-1, 1). As described any point (-1, 1) also is not even true. So that the line y = x + 1 instead

shifted to the top of the unit, but shifted to the bottom of y = x. While the graph y = x is not that make such chart or graph y = x^2 quadratic equation curve. But when asked is the graph of y = x2 most students could not answer

Student understanding of the graph y = c and x = c

Question 3 asked about the form of graphs y = k, or x= k and what a difference the two lines shows that the respondents did not understand the form of matter. Furthermore, when students are asked to make the line y = k, the line x = k and asked to explain the difference, over 90% of the students could not answer. Only 5% were correct and 3% answered incorrectly. Examples of student answers bleak Figure 6

Figure 6. Sample student answers on the graph y = x and x = k, only made as point (0,0)

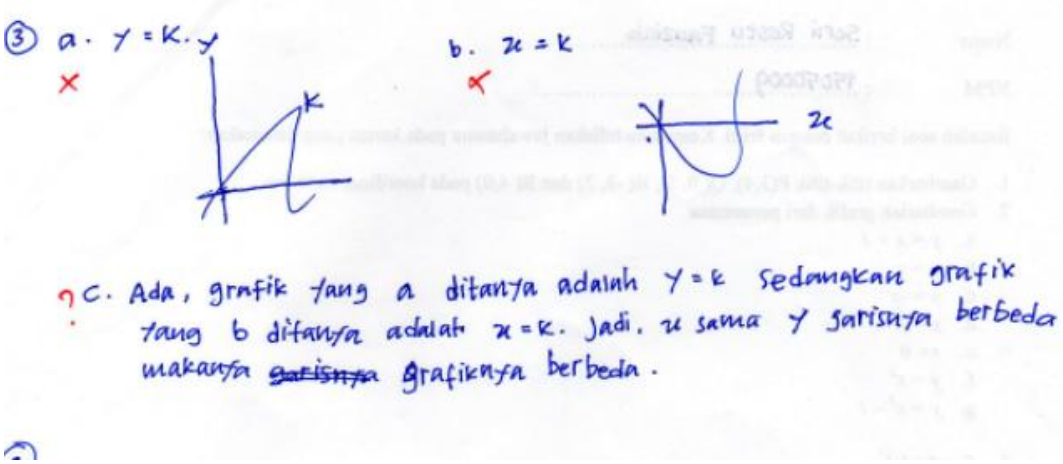

Figure 7. Sample student answers on the chart y = k, x = k and the differences between them

From Figure 7 and Figure 8 shows that the students' understanding is still very low on a line graph, the line should be drawn as a vertical line and a horizontal line instead is curved, and looks haphazard.

The experience and knowledge of previous students greatly affect the ability to draw graphs segaimana which has been described above. It is estimated that this is because students have the knowledge and concept of the limited line equation. This result is relevan with research by Hokyulu (2016), states that a positive relationship exists between

individuals' content knowledge they use and quantity of arguments they produce during a scientific argumentation . The mistake was also caused by confusion about the definition of function, not understanding the meaning of the variable (Hakyolu & Bekiroglu, 2016). As a result of research Dede (2011) that stated the experiences of preservice math teachers have confuse of the definition of function with one-to-one and onto properties (Dede & Soybas, 2011). Beside that, Uzun (2012) stated that although elementary and secondary schools instructional programs emphasize the importance of graphing, this study shows that students at undergraduate level have difficulties in performing tasks related to graphing skill. (Uzun, Sezen, & Bulbul, 2012)

These mistakes are also influenced by the ability to understand symbols and variables, many students are less aware of the meaning of symbols and variables that are displayed, whereas to graph the equivalence of students to understand it, as Alvarez (2015), (Álvarez & M[a], 2015), these include algebraic and functional models that require students to create, interpret and translate symbolic and graphic representations of relationships into precise equations.

KESIMPULAN

Based on the results and discussion can be concluded that:

1. An understanding of students to the coordinate system largely is good, though there is still an error in determining the coordinates.
2. Understanding students to graph a quadratic equation is still very low, and often mixed graphs of quadratic equations and linear equations.
3. An understanding of students to graph line equation is still very low, especially on understanding the line $y = k$ and $x = k$, where k is a number.

This research data is still limited drawn from first-year students at the beginning of the term that has not received repetition of material and just rely on memory and comprehension of students as they learn math in high school. Therefore that this research could be strengthened, it is recommended:

1. Conducting similar studies on students year 1, year 2, year 3 and is in the process of completion of studies.

2. Performing a search for errors student understanding by conducting advanced research by adding data through wider sample and add data collection through interviews.

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